PATENT APPLICATION
Navy Case No. 77,897

BEFORE THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In re application: Imam et al.
Serial No. 08/845,897
Filed: April 28, 1997
For: POROUS MATERIAL/ORGANIC POLYMERIC COMPOSITES

Examiner: Roche
Group Art Unit: 1771

May 15, 2001

REPLY BRIEF

Honorable Commissioner of Patents
Washington, D.C. 20231

Sir:

The present Reply Brief is submitted in response to the Examiner's Answer mailed on April 10, 2001. First, Appellants would like to present an overview of the invention claimed and then proceed to their arguments in support of a reversal of the Examiner's rejections.

BACKGROUND

The present invention relates to a composite of a metal foam having pores and a non-elastomeric plastic polymer. The foam has thin ligaments between its pores. Each pore of the metal foam has an outer surface. A plastic polymer fills each of the pores. The plastic polymer would also have an outer surface. The plastic polymer is continuous, i.e., there is only the polymer within each metal foam pore. Thus, there is an interface between the other surface of each filled metal foam pore and the outer surface of the plastic polymer filling that pore.

The polymer is a non-elastomeric material as opposed to being an elastomeric material. Elastomeric is meant to mean that the material has a glass transition temperature at or below

room temperature, it is rubbery at room temperature, and it stretches at room temperature. Non-elastomeric is meant to mean that the material has a glass transition temperature above room temperature, it is not rubbery at room temperature and it does not stretch at room temperature.

Sound can be described as energy. When sound waves travel through either the metal foam or the polymer, the energy is transformed at the interface, e.g., sound waves can transform into heat at the interface, and the sound waves are dissipated. The more dissipation of the sound waves the greater the acoustic damping of the material.

The present invention is an acoustic-damping material. The acoustic damping capabilities of the composite of the present invention arise in part from the acoustic properties of the polymerized resin component and in part from dissipation of energy at the polymer/metal interface. Energy is never transferred without loss at interfaces between different materials. Therefore, as the number of interfaces that an acoustic vibration must transverse increases, the percentage of dissipated acoustic energy also increases. A metal foam/polymer composite provides numerous interfaces between the polymer and the metal matrix.

ISSUES

A. Whether claims 1-4, 7, 11, 19 and 22 are anticipated by Tsang et al. (U.S. Patent No. 4,605,595) under 35 U.S.C. § 102(b).

B. Whether claims 1-4, 7, 19 and 22 are anticipated by, or rendered obvious by, Reitz (U.S. Patent No 4,759,000) under 35 U.S.C. § 102(b) or § 103.

C. Whether claims 17, 18, 20 and 21 are rendered obvious by either Tsang et al. or Reitz under 35 U.S.C. § 103.

ARGUMENT

A. Tsang et al. discloses a slurry made up of a filler, a friction modifier, and a reinforcing fiber carried in a liquid binder solution drawn into the pores of a foam until a desired density is

obtained, Col. 1, lines 53-60, and Col. 3, lines 19-33. Tsang et al. relates to the substitution of asbestos with a friction modifier and a filler in a brake pad. The friction modifiers disclosed were coke, iron powder, cashew nut powder, zinc, and brass and the fillers disclosed were barytes, talc and whiting. Fig. 2 discloses coke, rubber and iron powder as a friction modifier and barytes and whiting as a filler. The weight % of friction modifiers is between 13 and 18% and the weight % of the fillers is between 34 and 50% for a total between 47 and 78 weight %. These two (2) materials are found in all the Examples in Fig. 2. Both fillers and friction modifiers are the invention in Tsang et al. and not a curing additive, see Col. 4, lines 21, in which a curing agent was added to the epoxy resin, fillers and friction modifiers.

Applicants' specification, page 8, lines 2-3, discloses the use of a resin component "or may include any catalyst, curing agent, or additives desired." What was meant by "additives desired" was **curing** additives desired. The plastic polymer is continuous so as not to disrupt the structural integrity of the composite and/or the polymeric component. The Examples 2, 3, 4, 6 use a "curing additive" with the prepolymer synthesized in Example 1. Examples 5, 7, 8, 9, and 10 did not use a curing additive. The curing additive was the only additive added and again it was a "curing additive." This should support that an inadvertent typographical error occurred and that the word "curing" should be inserted before the word "additive." A reading of the whole specification will reveal that no friction modifiers or fillers were disclosed. If a friction modifier or filler were used in the invention it would materially affect the basic and novel characteristics of the claimed invention. Both fillers and friction modifiers are the invention in Tsang et al. and not a curing additive, see Col. 4, lines 21, in which a curing agent was added with the epoxy resin, fillers and friction modifiers.

The Federal Circuit in Constant v. Advanced Micro-Devices Inc., 7 U.S.P.Q.2d 1057, 1064 (Fed. Cir. 1988), stated: "[a] claim is anticipated only if each and every element as set forth

in the claim is found, either expressly or inherently described, in a single prior art reference." Tsang et al. does not anticipate claims 1-4, 7, 11, 19 or 22.

In the alternative to the Board reversing the Examiner's rejection of claims 1-4, 7, 11, 19 and 22 based on the above explanation, Applicants suggest that the Board return the above-identified case to the Examiner so that the transition language in claims 1 and 22 can be amended to recited "consisting essentially of" instead of "comprising." Applicants would also suggest that the Board suggest that the specification at page 8, line 3, be amended to insert –curing– before "additive desired" as its omission was a typographical error and is clearly supported by Examples 2, 3, 4, and 6 and has certainly caused much confusion to the Examiner.

As claims 2-4, 7, 11 and 19 depend from claim 1 and contain all the limitations of claim 1, it is felt that claims 2-4, 7, 11 and 19 distinguish from the cited reference in the same manner as claim 1 and therefore are patentable.

B. Claims 1 and 22 recite to a "non-elastomeric" polymeric matrix/polymerized resin. Reitz discloses a silicone rubber/rubber that fills the pores of an aluminum-nickel foam, Col. 9, line 66 to Col. 10, line 11. Again, applicants have caused confusion to the Examiner and do apologize. Claim 3 should have been amended in the Preliminary Amendment to delete "hardened silicones" and "hardened natural rubbers, hardened synthetic rubbers" or the applicants should have recited --except silicon rubbers– or applicants should have recited --plastic– before each hardened in claim 3.

The Federal Circuit in Constant v. Advanced Micro-Devices Inc., 7 U.S.P.Q.2d 1057, 1064 (Fed. Cir. 1988), stated: "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Reitz does not anticipate claims 1-4, 7, 19 or 22 as Reitz utilizes an elastomeric rubber and applicants claim a non-elastomeric polymer matrix/resin, i.e., a plastic.

There is no suggestion, motivation or teaching in Reitz to use a non-elastomeric polymer and therefore Reitz does not make the claims 1 and 22 obvious.

In the alternative to the Board reversing the Examiner's rejection of claims 1-4, 7, 19 and 22 based on the above explanation, Applicants suggest that the Board return the above-identified case to the Examiner so that the transition language in claims 1 and 22 can be amended to recited "consisting essentially of" instead of "comprising." Applicants would like to amend claim 3 to delete "hardened natural rubbers, hardened synthetic rubbers" and "hardened silicones" which were, inadvertently, not deleted in their Preliminary Amendment and clearly added to the Examiner's confusion.

As claims 2-4, 7, and 19 depend from claim 1 and contain all the limitations of claim 1, it is felt that claims 2-4, 7, and 19 distinguish over Reitz in the same manner as claim 1.

C. To establish a prima facie case of obviousness, three basic criteria must be met.

1. there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings,
2. there must be a reasonable expectation of success, and
3. the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP 2143.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure, In re Vaeck, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991).

In Ruiz v. A.B. Chance Co., 57 U.S.P.Q.2d 1161 (Fed. Cir. 2000), the Federal Circuit stated "[i]n order to prevent a hindsight-based obviousness analysis, we have clearly established that the relevant inquiry for determining the scope and content of the prior art is whether there

is a reason, suggestion or motivation in the prior art or elsewhere that would have led one of ordinary skill in the art to combine the references."

Reitz does not disclose a pore size with regard to claim 21. Reitz only discloses "[h]ousing sheet 61 in this embodiment comprises a porous metal foam such as aluminum-nickel impregnated with rubber, Col. 9, line 66 to Col. 10, line 11." The Examiner admits that Reitz does not specifically disclose the thickness of the metal foam being no less than 3 times the average diameter of the cells, Examiner's Answer, page 4, second full paragraph, and Office Action mailed on August 25, 1999, section 9. The Examiner stated that:

> [I]t would have been obvious to one having ordinary skill in the art at the time the invention was made to have optimized either the thickness of the metal foam or average cell diameter of the metal foam, since it has been held that where the general conditions of a claim are disclose in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 U.S.P.Q. 233. In the present case, it would have been obvious to the skilled artisan to have prepared a thicker metal foam, motivated by the desire to enhance the tensile strength and barrier properties of the metal foam. And, it would have been obvious to the skilled artisan to have prepared a metal foam having a smaller average cell diameter, motivated by the desire to have optimized the compressive, flexural, shear and tensile strength of the resulting impregnated foam.

The Examiner has enumerated certain properties, i.e., compressive, flexural, shear and tensile strength, which would motivate a skilled artisan. The only desired property by Applicants was "good acoustic damping." Applicants are not sure where the Examiner found the other characteristics that she enumerated.

In the reference cited by the Examiner, In re Aller, 105 U.S.P.Q. 233, 235 (CCPA 1955), the prior art recited the parameters only they were different from those claimed by appellant. In

the Reitz and Tsang et al. references there are **no** disclosures of the foam thickness and there are **no** disclosures of pore size, i.e., no optimum or workable range were recited. The metal foam of Reitz is a housing sheet 61 and it is **not** an acoustically absorptive material, Col. 10, lines 3-6. Tsang et al. reference has no disclosure with regard to acoustic damping as it relates to the substitution of fillers and friction modifiers for asbestos in brake pads, non-analogous art.

The Examiner is not only adding to the prior art disclosures when she/he states that because there is a metal foam it inherently has pores. Then the Examiner states that "it would have been obvious to one having ordinary skill in the art at the time the invention was made to have optimized either the thickness of the metal foam or the average cell diameter of the metal foam."

Thus, there is no motivation for an artisan to use either Tsang et al. or Reitz. Clearly, the elements of prima facie obviousness have not been met. It appears that the Examiner is using hindsight for determining obviousness as well as desired characteristics. Uniroyal v. Rudkin-Wiley, 5 U.S.P.Q.2d 1434, 1438 (Fed. Cir. 1988).

Claims 17, 18 and 20 depend from and include all the limitations of claim1, it is felt that claims 17, 18 and 20 distinguish from the cited references in the same manner as claim 1 and therefore are patentable.

In the alternative to the Board reversing the Examiner's rejection of claim 21 based on the above argument, Applicants suggest that the Board return the above-identified case to the Examiner so that the transition language in claim 21 can be amended to recited "consisting essentially of" instead of "comprising."

CONCLUSION

Applicants have attached hereto a corrected Appendix-The Claims on Appeal in which polyimides is now correctly spelt in claim 3, and a Proposed Claim Amendment. Applicants are

respectfully submitting that the Board reverse the Examiner's rejections as the art of record neither anticipates or makes obvious claims 1-4, 7, 11, 17-22, or in the alternative, return the above-identified application to the Examiner so that the transition language in claims 1, 21 and 22 can be amended to recite "consisting essentially of" and claim 3 can be amended to delete " hardened silicones" and "hardened natural rubbers, hardened synthetic rubbers."

Kindly charge and additional fees due, or credit overpayment of fees, to Deposit Account 50-0281.

Respectfully submitted,

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CERTIFICATION OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office on the date shown below.

5/15/01
Date

Jane Barrow Marciniszyn

Appendix - The Claims on Appeal

What is claimed is:

1. (Amended) An acoustically damping composite article, comprising a non-elastomeric polymeric matrix having therein a metal foam, said metal foam having an open cell structure, said metal foam being impregnated with said polymeric matrix so as to completely penetrate said open cell structure of said foam and fill the cells thereof.

2. The composite article of claim 1, wherein said metal is selected from the group consisting of aluminum, aluminum base alloys, titanium, titanium base alloys, nickel, nickel base alloys, copper, copper base alloys, iron, iron base alloys, zinc, zinc base alloys, lead, lead base alloys, silver, silver base alloys, gold, gold base alloys, platinum, platinum base alloys, tantalum, and tantalum base alloys.

3. The composite article of claim 1, wherein said polymer is selected from the groups consisting of epoxies, acrylics, hardened silicones, polyurethanes, polyamides, polyvinyls, polycarbonates, hardened natural rubbers, hardened synthetic rubbers, phenolics, polyolefins, polyimides, polyesters, fluoropolymers, poly(phenylene ether ketones), poly(phenylene ether sulfones), poly(phenylene sulfides) and melamine-formaldehyde resins.

4. The composite article of claim 1, wherein said metal is an aluminum base alloy foam.

5. Withdrawn

6. Withdrawn

7. The composite article of claim 3, wherein said metal is an aluminum foam or an aluminum base alloy foam.

8. Withdrawn

9. Withdrawn

10. Withdrawn

11. The composite article of claim 1, wherein said polymer is an epoxy.

12. Withdrawn

13. Withdrawn

14. Withdrawn

15. Withdrawn

16. Withdrawn

17. The composite article of claim 1, wherein said cells have a locally uniform diameter.

18. (Amended) The composite article of claim 1, wherein said metal foam has a gradation of pore sizes in at least one direction along the metal

19. A composite article according to claim 1, wherein said composite article is in the form of a sheet.

20. (Amended) A laminate comprising a stack of sheets according to claim 19 bonded together.

21. (Twice amended) An acoustically damping composite article, comprising a polymeric matrix having therein a metal foam, said metal foam having an open cell structure, said metal foam being impregnated with said polymeric matrix so as to completely penetrate said open cell structure of said foam and fill the cells thereof, said metal foam thickness no less than 3 times the average diameter of said cells.

22. A method of forming a composite comprising the steps of:

impregnating a metal foam, said metal foam having an open cell structure, with a resin component so as to completely penetrate said open cell structure of said foam and fill the open cells of said metal foam with said resin component; and

converting said resin component, within said cells, to a bulk solid, non-elastomeric polymerized resin, thus forming a composite comprising a matrix of said non-elastomeric polymerized resin, said matrix having therein said metal foam.

PROPOSED CLAIM AMENDMENT

In the claims:

1. (Twice Amended) An acoustically damping composite article, ~~comprising~~ consisting essentially of a non-elastomeric polymeric matrix having therein a metal foam, said metal foam having an open cell structure, said metal foam being impregnated with said polymer matrix so as to completely penetrate said open cell structure of said foam and fill the cells thereof.

3. (Amended)The composite article of claim1, wherein said polymer is selected from the groups consisting of epoxies, acrylics, ~~hardened silicones,~~ polyurethanes, polyamides, polyvinvyls, polycarbonates, ~~hardened natural rubbers, hardened synthetic rubbers,~~ phenolics, polyolefins, ~~polyamides~~ polyimides, polyesters, flurorpolymers, poly(phenylene ether ketones), poly(phenylene ether sulfones), poly(phenylene sulfides) and melamine-formaldehyde resins.

21. (Three Times Amended) An acoustically damping composite article, ~~comprising~~ consisting essentially of a polymeric matrix having therein a metal foam, said metal foam having an open cell structure, said metal foam being impregnated with said polymeric matrix so as to completely penetrate said open cell structure of said foam and fill the cells thereof, and said metal foam thickness no less than 3 times the average diameter of said cells.

22. (Amended) A method of forming a composite ~~comprising~~ consisting essentially of the step of:

impregnating a metal foam, said metal foam having an open cell structure, with a resin component so as to completely penetrate said open cell structure of said foam and fill the open cells of said metal foam with said resin component; and

converting said resin component, within said cells, to a bulk solid, non-elastomeric polymerized resin, thus forming a composite comprising a matrix of said non-elastomeric polymerized resin, said matrix having therein said metal foam.